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(12) AUSTRALIAN PATENT ABSTRACT
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(54) TERMITE PROOF ASPHALT SHEET

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(57) —

The present invention relates to a termite-proof asphalt sheet.

It is an object of the present invention to provide a new termite-proof building material which can exert a very strong termite-killing power for many years and prevent the wooden construction against the termites, just by pre-laying it under a floor or upon a foundation at the time of construction.

It is another object of the present invention to provide a termite-proof building material which is mixed with a thermoplastic elastomer so as to give a gum-like elasticity to the asphalt.

It is still another object of the present invention to provide a termite-proof asphalt sheet of which the composition is improved so as to eliminate manufacturing difficulties while maintaining its excellent property as a termite-proof building material and to lower the cost to zero the bad influence exerted upon the added natural substance by heat at the time of manufacturing. Since

.../2

the organic phosphorous compound is added into the asphalt melted at a high temperature, the organic phosphorous compound is highly volatilized. This causes an increase in the manufacturing cost and also an environmental pollution by the peculiar bad smell caused at the volatilization. The present invention is provided in order to solve these problems.

Claim

1) A termite-proof asphalt sheet which is a sheet-form asphalt molding product and which contains in uniform dispersion at a predetermined density an immediate effective insecticide of which an active ingredient is at least one kind of organic phosphorous compound selected from fenitrothion, phoxime, chlorpyrifos, acephate and prothiophos; and an effect sustairing stabilizer of which an active ingredient is an organic acid metal complex such as zinc octylic acid or zinc versatic acid.

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COMPLETE SPECIFICATION
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Complete Specification for the invention entitled:

TERMITE-PROOF ASPHALT SHEET

The following statement is a full description of this invention including the best method of performing it known to me :-

Conventional steps have been taken so as to prevent the termites in complying with such demand. One of them is a termite-preventing metal plate to be inserted between the sill and the foundation. The other step is termite-preventing treatment to be provided with insecticide such as dieldrin, pentachlorphenol, etc., on wood to be used for the wooden construction and/or in the soil at the construction site.

However, the former step of using the termite-preventing metal plate is easily conquered by Termite Bridge which the termites construct by instinct while the latter step of the termite-preventing treatment finds it very difficult to protect the wooden construction against the termites for 20 to 30 years in view of the effective duration of the insecticide provided in the soil. Therefore more perfect step to realize the protection of long duration must be taken.

The present inventor felt very unsatisfied with these conventional techniques, and for the purpose of developing a much more perfect termite-preventing technique, he firstly paid his attention to the quality of the building material constituting the wooden construction and then he started his study believing that it would be possible to eliminate the termites from the construction for many years if the building material is used which has the property of killing/preventing the termites for a long period.

Thus, his first attempt was to blend an insecticide into a vinyl chloride resin and to mold therefrom into a termite-proof sheet. Upon starting an actual experiment, however, he encountered with a problem as to what kind of insecticide should be mixed so as to obtain the building material which keeps its termite-killing power strong for a long period of 20 to 30 years but which is not toxic to human body. If the insecticide is chosen regarding only the termite-killing power as important and disregarding the toxicity to the human body, then the building material comprising thereof will be harmful to the construction workers' health since they

handle these building materials.

Therefore the present inventor chose chlordane of which the toxicity to human body is relatively low but which has a very strong and long-continuing power of killing the termites and started to mix it into a synthetic resin material (actually a vinyl chloride resin) for molding a product. However this experiment ended in a failure. It proved that chlordane cannot be used because it is unstable to heat and, for the most part, volatilized at the molding temperature of vinyl chloride resin, and in addition thereto chlordane oozes out of the molding product.

The present inventor further continued his trial-and-error experiment so as to overcome the aforementioned problems and he finally found a fact that if the mixture of the organic phosphorous compound having strong killing power and taking an immediate effect and the organic acid metal complex, such as metal octylic acid or metal versatic acid, having no killing power but enabling the insecticide to keep its effect extremely long are blended into the synthetic resin for molding, then this molding product has a very powerful and long-lasting effect of killing the termites. But there are many kinds of the organic phosphorous compounds, and some of them are toxic to human body while some are ineffective against the termites. Consequently he was forced to make a specific investigation of the organic phosphorous compounds one by one and as a result he came to the conclusion that fenitrothion, phoxime and acephate are appropriate as insecticide to be mixed and that the effective duration thereof increases when used with zinc octylic acid or zinc versatic acid. Thus he succeeded in molding a sheet-form product from the mixture of these chemical substances. The vinyl chloride sheet thus obtained has no problem that the insecticide oozes out and shows a strong termite-killing power as is confirmed by the experiment.

However another problem has been found in the vinyl chloride sheet. The vinyl chloride resin becomes deteriorated and easy to break if it is exposed for a long period to an environment with

extremes of temperature or with high temperature and high humidity. Therefore there arose a problem that the sheet laid under a floor easily broke during the construction.

In view of the above, the present inventor furthered his study seeking a sheet molding material which is suitable to be mixed with the insecticide and the satbilizer and as a result thereof he made the present invention.

Summary of the Invention

The present invention relates to a termite-proof asphalt sheet.

It is an object of the present invention to provide a new termite-proof building material which can exert a very strong termite-killing power for many years and prevent the wooden construction against the termites, just by pre-laying it under a floor or upon a foundation at the time of construction.

It is another object of the present invention to provide a termite-proof building material which is mixed with a thermoplastic elastomer so as to give a gum-like elasticity to the asphalt.

It is still another object of the present invention to provide a termite-proof asphalt sheet of which the composition is improved so as to eliminate manufacturing difficulties while maintaining its excellent property as a termite-proof building material and to lower almost to zero the bad influence exerted upon the added chemical substances by heat at the time of manufacturing. Since the organic phosphorous compound is added into the asphalt melted at a high temperature, the organic phosphorous compound is highly volatilized. This causes an increase in the manufacturing cost and also an environmental pollution by the peculiar bad smell emitted at the volatilization. The present invention is provided so as to solve these problems.

Detailed Description of the Invention

According to the present invention, there is provided a termite-proof asphalt sheet which is a sheet-form asphalt molding product and which contains in uniform dispersion at a predetermined density an immediately effective insecticide of which an active ingredient is at least one kind of organic phosphorous compound selected from fenitrothion, phoxime, chlorpyrifos, acephate or prothiophos; and an effect sustaining stabilizer of which an active ingredient is an organic acid metal complex such as zinc octylic acid or zinc versatic acid.

A thermoplastic elastomer is mixed so as to give a gum-like elasticity to the asphalt. As the thermoplastic elastomer, for example, a synthetic polymer is used which is a styrene-monomer or a diene-monomer polymerized in a form of linear block or radial block. By mixing the asphalt with this thermoplastic elastomer 15 to 25 % by weight, said asphalt becomes very elastic even at the normal temperature.

According to the present invention, the above molding material is mixed with the immediately effective insecticide of which the active ingredient is the organic phosphorous compound and the effect sustaining stabilizer of which the active ingredient is the organic acid metal complex, and all of the mixture is uniformly dispersed and thereafter molded therefrom into a sheet-form product. When using fenitrothion or phoxime, for example, as the organic phosphorous compound, the mixture ratio thereof is about 0.5 to 5 % by weight of the total amount. So as to make a termite-proof asphalt sheet having a gum-like elasticity and containing the insecticide and the effect stabilizer in uniform dispersion, the thermoplastic elastomer together with the insecticide and the stabilizer is added into the asphalt melted at about 150 to 170°C, then well mixed, and thereafter roller-coated upon a base sheet such as an unwoven fabric or a lawn, thereby obtaining a sheet-form product of a desired thickness.

In the present invention, a petroleum resin may be added to make the termite-proof sheet adhesive, and furthermore an aromatic oil may be added as an auxiliarly agent for promoting the mixture of respective chemical substances.

The asphalt sheet according to the present invention may comprise a base sheet coated with an asphalt. In other words, there is provided a termite-proof asphalt sheet comprising a base sheet coated with an asphalt, said base sheet being uniformly impregnated with the immediately effective insecticide of which an active ingredient is at least one kind of organic phosphorous compound selected from fenitrothion, phoxime, chlorpyrifos, acephate or prothiophos; and the effect sustaining stabilizer of which an active ingredient is the organic acid metal complex such as zinc octylic acid or zinc versatic acid.

In further details, so as to uniformly impregnate the base sheet with the insecticide and the stabilizer, these chemical substances are pre-dissolved in a solvent, for example a toluene, and then the base sheet is saturated with this solution. In this case, the base sheet may be an unwoven fabric, a lawn, a foamed resin sheet, etc. which has such surface that can easily contain and hold the solution, and the base sheet may be soaked in or sprayed with the solution according to the kind of the base sheet.

So as to coat the above chemically treated base sheet with the asphalt, the sheet may be roller-coated with the molten asphalt being heated at about 135°C. By this method, the effective chemical substances are hardly volatilized because they are subject to a relatively low heat for a relatively short time, and the termite-proof asphalt sheet of a desired thickness is available in the condition that such volatilization is hardly seen.

In the present invention, the impregnation of the base sheet with said chemical substances is naturally possible after coating a non-treated base sheet with the asphalt. The impregnation can be made more efficiently in case that the asphalt coating is provided on one side of the bas sheet.

The present invention will b explained with reference to the following examples.

Example 1

60/80 straight asphalt	50
Themoplastic elastomer (Solprene manufactured by Asahi Kasei Kogyo Kabushiki Kaisha)	18
Aromatic oil (Petrex PF-2 manufactured by Yamabumi Yuka Kabushiki Kaisha)	23
Petroleum resin (Petrogin manufactured by Mitsui Sekiyu Kagaku Kabushiki Kaisha)	7.5
Fenitrothion	1
Zinc versatic aicd	0.5

The above composition is heated and melted at 170°C, stirred up into uniform dispersion, roller-coated onto a polyester unwoven fabric, and molded into an 1 mm-thick soft sheet having a softening point at 89°C. The sheet has initially a viscosity because of the petroleum resin.

Example 2

60/80 straight asphalt	70
Thermoplastic elastomer (Solprene manufactured by Asahi Kasei Kogyo Kabushiki Kaisha)	10
Aromatic oil (Petrex PF-2 manufactured by Yamabumi Yuka Kabushiki Kaisha)	18.5
Phoxime	1
Zinc octylic acid	0.5

The above composition is heated and melted at 170°C, stirred up into uniform dispersion, roller-coated onto a polyester unwoven fabric, and molded into an 1 mm-thick soft sheet.

Test example

The following table shows the results of testing the termite-killing power and the effective duration thereof regarding test strips numbered 1, 2, 1' and 2'. The test strips 1 and 2 are the above examples 1 and 2, respectively, while those 1' and 2' are the above examples 1 and 2 but which had been exposed in a pyrostat at 60°C for six months.

Termite Death Rate (%)

Test strip	1 day	3 days	5 days	1 week
1	80	100	/	/
2	50	70	100	/
1'	60	80	100	/
2'	60	80	100	/
Non-treated asphalt sheet	0	0	0	0

Each test strip used for the above test is a sheet-form molding product which is 5 cm long, 5 cm wide and 1 mm thick.

The test was conducted in a cylindrical container which is 10 cm in diameter and 7 cm in depth. On the bottom thereof was laid a gypsum (a new plaster) on which was placed the test strip. 150 workers and 150 soldiers of Coptotermes formosana were put into the container so as to observe how many of them were killed in an environment kept at the temperature of 28±1°C and the humidity of 85%.

Furthermore, they test strips were left under an environment where both temperature and humidity are high (the temperature is 50°C and the humidity is 91%) for two years but they did not lose at all the softness. In addition thereto, they sustain the termite-killing power for such period and have not been destroyed by the termites.

In view of the above test, the asphalt sheet of the present invention can be used for at least 25 years.

The following table shows other examples of an asphalt sheet wherein a base sheet is coated with an asphalt. The examples 3 to 7 are obtained by impregnating the base asphalt sheet with the following solutions (a) to (b) (70cc per 1 m^2).

Examples (% by weight)

solution	(a)	(b)	(c)	(d)	(e)
Fenitrothion	1				
Phoxime		1			
Chlorpyrifos			0.7		
Acephate				0.7	
Prothiophos					1
Zinc octylic acid		0.5	0.5		0.5
Zinc versatic acid	0.5			0.5	
Toluene	98.5	98.5	98.8	98.8	98.5

Test results Termite Death Rate (%)

Before exposed outdoor

Example	1 day	3 days	5 days	1 week
3	65	75	97	100
4	60	73	99	100
5	59	81	93	100
6	58	80	95	100
7	65	70	98	100

Test results Termite Death Rate (%)

After exposed outdoor

Example	1 day	3 days	5 days	1 week	2 weeks
3	55	70	89	100	
4	40	61	90	98	100
5	50	62	85	100	
6	53	63	87	100	
7	54	71	90	95	100

The termite-killing effect of the asphalt sheet which is not added with the above chemical substances (hereinafter referred to "non-treatment") had been observed for 3 weeks. It was revealed that the number of the termites were not decreased and that the sheet was destroyed by them.

Test results

Termite Death Rate (%) When the effect sustaining stabilizer not added

	5 days	1 week	2 weeks	3 weeks	4 weeks	5 weeks
Example 1'	40	45	50	60	70	80
" 2'	40	45	50	60	65	70
" 3'	40	48	55	65	70	80
" 4'	20	30	35	40	55	60
" 5'	40	45	48	55	60	70
Non-treatment	0	0	0	0	20	40

The above examples 1' to 5' correspond to the examples 3 to 7 excluding the effect sustaining stabilizer, respectively.

The following table shows still other examples of the present invention.

Examples (% by weight)

Examples	A	B	C	D	E
60/80 straight asphalt	50	70	70	50	50
Thermoplastic elastomer	18	10	10	18	18
Aromatic oil	23	13.5	18.5	23	23
Petroleum resin	7.5			7.8	7.5
Fenitrothion	1				
Phoxime		1			
Chlorpyrifos			0.7		
Acephate				0.7	
Prothiophos					1
Zinc-octylic acid		0.5	0.5		0.5
Zinc versatic acid	0.5			0.5	

Test results

Termite Death Rate (%) — Before exposed outdoor

	1 day	3 days	5 days	1 week
Example A	80	100	/	/
" B	70	100	/	/
" C	70	80	100	/
" D	80	90	100	/
" E	50	70	100	/

Termite Death Rate (%) — After exposed outdoor for six months

The effect sustaining stabilizer not added

	5 days	1 week	2 weeks	3 weeks	4 weeks	5 weeks
Example A'	20	40	60	80	80	100
" B'	20	40	60	80	80	80
" C'	10	20	30	50	70	100
" D'	10	20	20	40	60	60
" E'	10	10	20	30	50	70
Non-treatment	0	0	0	0	20	40

* regarded as natural death

Termite Death Rate (%) — After exposed outdoor

	1 day	3 days	5 days	1 week	2 weeks
Example A	60	80	100	/	/
" B	60	80	100	/	/
" C	50	70	80	100	/
" D	60	80	90	100	/
" E	20	40	60	80	100
Non-treatment	0	0	0	0	0

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1) A termite-proof asphalt sheet which is a sheet-form asphalt molding product and which contains in uniform dispersion at a predetermined density an immediate effective insecticide of which an active ingredient is at least one kind of organic phosphorous compound selected from fenitrothion, phoxime, chlorpyrifos, acephate and prothiophos; and an effect sustaining stabilizer of which an active ingredient is an organic acid metal complex such as zinc octylic acid or zinc versatic acid.

2) A termite-proof asphalt sheet as claimed in Claim 1 wherein said sheet-form asphalt molding product is given with a gum-~~like~~ elasticity.

3) A termite-proof asphalt sheet as claimed in Claim 1 wherein said sheet-form asphalt molding product comprises a base sheet coated with the asphalt.

Dated this 19th day of July 1983.

KOICHI NISHIMOTO

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